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HAWAII AGRICULTURAL EXPERIMENT STATIO

J. G. SMITH, SPECIAL AGENT IN CHARGE.

BULLETIN No. 1.

CHICKENS AND THEIR DISEASES IN HAWAII.

BY

T. F. SEDGWICK,

Agriculturist, Hawaii Agricultural Experiment Station.

UNDER THE SUPERVISION OF

OFFICE OF EXPERIMENT STATIONS,

U. S. DEPARTMENT OF AGRICULTURE.

162 4621
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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.

ULTURAL EXPERIMENT STATION, HONOLULU.

on of A. C. TRUE, Director of the Office of Experiment
s, United States Department of Agriculture.]

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LETTER OF TRANSMITTAL.

HONOLULU, HAWAII, *December 1, 1901.*

DEAR SIR: I have the honor to transmit herewith a bulletin on chickens and their diseases in Hawaii, prepared under my supervision by Mr. T. F. Sedgwick, agriculturist of this station, which I respectfully recommend for publication as Bulletin No. 1, of the Hawaii Agricultural Experiment Station.

Very respectfully,

JARED G. SMITH,
Special Agent in Charge of the Hawaii Agricultural Experiment Station.

Dr. A. C. TRUE,
Director Office of Experiment Stations,
U. S. Department of Agriculture, Washington, D. C.

Recommended for publication.

A. C. TRUE,
Director.

Publication authorized.

JAMES WILSON,
Secretary of Agriculture.

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INTRODUCTION.

Chicken raising is an extremely uncertain industry in the Territory of Hawaii, as evinced by the high prices both of eggs and poultry, live or dressed. Fresh eggs sell in the Honolulu markets at from 45 to 60 cents per dozen, while the ruling prices for live fowls range from $12 to $18 per dozen, depending on their age, condition, and breed. For pure-bred fowls even higher prices are asked and given. This condition of scarcity is unusual in any country. It makes eggs and chickens a luxury only within the means of the well-to-do, instead of contributing to the daily bill of fare of all the people.

In the country districts the mongoose has much to do with causing this state of affairs, because of his preference for young chickens, but even in the towns, where the mongoose is seldom seen, poultry raising is and has been a precarious industry as far back as authentic records extend. This is mainly because of the great number of diseases prevalent here, as elsewhere in the tropics. Chief among these is a malady commonly known as sore head, which decimates the flocks at the time when the chicks are being weaned by the mother hen. Roup, diarrhea, cholera, and especially colds and pneumonia, are also all too prevalent, while lice and intestinal worms do their share toward depleting the chicken yards. Most of these diseases are due to neglect, improper care, and faulty yards and houses, and all are largely preventable.

It does not require close calculation to show that chicken raising can be made profitable in these islands if the grower will devote as much care and attention to details as in any other minor industry. The high prices for eggs and chickens and the amount consumed prove that such close care and attention to the details of the business would be profitable. During the year 1900 there were imported into Honolulu alone, from the mainland, about 40,000 dozens of eggs and about 75,000 pounds of dressed chickens, besides numerous lots of live fowls. The value, wholesale, for imported eggs was about $12,000, and for refrigerated chickens about the same. Thus, besides the home supply, there were imported for the use of the one island of Oahu fully $25,000 worth of eggs and chickens. Hawaii, Maui, Kauai, and the smaller islands are not taken into consideration in this calculation, but a good many cases of eggs find their way direct to Hilo, Lahaina, and Lehua from California. The supplying of steamships and sailing vessels with fresh eggs and live poultry ought in itself to be a lucrative trade. Of food there is plenty to raise many

times the number of chickens now existing on Oahu. A brood of chickens in the dooryard, vineyard, or orchard would soon pay for their keep in the destruction of Japanese beetles and other insect pests. The wastes from the kitchen and table could also be turned to more general account. Clean houses, nests, and roosts, pure water, good food, plenty of sunshine and shelter from the winds, a dust bath, some broken coral, daily care to keep the birds healthy, and instant isolation of ailing members of the flock will do a great deal to lower the price and increase the sales of fresh eggs and spring chickens in Hawaii.

JARED G. SMITH,
Special Agent in Charge, Hawaii Experiment Station.

CHICKENS AND THEIR DISEASES IN HAWAII.

By T. F. Sedgwick,

Agriculturist, Hawaii Experiment Station.

The raising of chickens in warm climates presents greater difficulties than in temperate latitudes. Uniformity of temperature, abundant sunshine, and refreshing showers would seem to indicate that the Tropics possess all the conditions favorable to the propagation of poultry. Long experience has demonstrated that this is not the case. The early records of Hawaiian agriculture show that the poultry grower has had to fight enemies, both predatory and parasitic, ever since chickens were introduced. There are more enemies to contend with at the present day than formerly, because importations of poultry have included importations of new pests.

This bulletin is intended to present the condition of chicken raising in Hawaii, mark out improvement in methods of management, and suggest lines for experiment and systematic investigation. It is hoped that this publication will arouse a combined effort of poultry growers in the islands to work together in overcoming some of the most prominent obstacles. It deals with the most important diseases among chickens in Hawaii, and those which materially hinder successful raising for market. So prevalent are some of these diseases that many newly hatched flocks are swept out of existence in the course of a few months. An example of this is shown in the experience of one grower in Honolulu, who hatched out a flock of 400 chicks some months ago, and at the present time (September, 1901) has only 40.

HISTORICAL.

The early records show that Captain Cook, on his voyage of exploration, was supplied with chickens at Waimea, on Kauai, in the early part of 1778. This fact indicates that fowls were on the islands previous to the advent of the first whites and under some degree of domestication. The "native hen," as it is called, was small and the eggs, likewise small, were not of a good flavor. The hens were at that time reported to be good layers, good setters, and excellent mothers. Whether any historical value can be attached to this native bird as regards the early settlement of the islands is a question. Nevertheless, if the true native chicken could be found at this day its identity might be determined and its history traced back to the country from which it came. This is not an easy matter, how-

ever, and would require the efforts of poultry experts of both the European and Asiatic countries. The mountains at the present day are the homes of many so-called "wild" chickens and turkeys. It is here that the true native chicken would probably be found. Even here, however, there is a chance of error, in that the climate is so equitable that domesticated chickens might find their way to the mountains and survive and cross with the native birds. In this same connection the native chicken might be used as a stock on which to breed systematically to produce a bird well adapted to tropical climates, and one which would resist the diseases which so infest the tropical poultry yard. The native fowl is described as being small in body, with short legs, and generally light in weight, probably resembling the Leghorns in mode of life. As far back as 1848, and probably earlier, the foreign settlers of these islands interested themselves in the improvement of the native stock by crossing them with introduced breeds, and at this time records show the following breeds, or classes of breeds, were represented on the Hawaiian Islands: A native chicken, or that which was found in existence here at the discovery of the islands; the Frizzled fowl, supposed to have been originally imported from Japan; a mixed Malay, of which the cock is a great fighter; the Cochin China; the Shanghai; and the Spanish. Game fowls were imported from Valparaiso, as well as the Frizzled, although the latter were supposed to be native of Japan. Cross-breeding was indulged in, as will be seen from the following quotation from the report of the committee on poultry, Royal Hawaiian Agricultural Society, 1852:

> The principal stocks on these islands are composed of crosses between the native hen, Shanghais, Malays, and Spanish fowls.

These mixtures, then, form part of the common mixed breeds of the present day, which will be found quartered in the native huts or sharing food with the pigs, dogs, ducks, water buffaloes, and even the inmates of some industrious Chinese houses.

Pure breeds of White Leghorns, White Wyandottes, Black Spanish, an occasional Plymouth Rock, Brown Leghorns, and Brahmas are sometimes seen. It is quite natural to suppose that from time to time representatives of most of the standard breeds have been imported, leaving their traces in the mongrel breed which is generally seen in the yards.

PREVAILING DISEASES.

An attempt is here made to deal only with those diseases which may become epidemic or which may be frequently met with. Such diseases, therefore, as liver complaint, egg bound, troubles caused by bruises of body or crop, dropsy, peritonitis, or any of the diseases which may be peculiar to a few, will not be discussed. The diseases

which are prevalent on these islands, and which tend to influence the production of chickens to a considerable extent, are colds, catarrh, distemper, roup, sore head, pneumonia, light attacks of diarrhea, canker in the mouth, cholera, and those enemies of the chicken yard which promote diseases—lice, worms, mosquitoes, etc. These latter may render the chicken subject to inoculation by breaking the skin, as in the case of the mosquito and louse, or they may lower the vitality of the fowl, as in the case of the intestinal worm, which appropriates the food the chicken eats to satisfy its own appetite.

CHICKEN POX (SORE HEAD).

While no records are in existence as to all the different diseases to which chickens were subject in the early days, some have been recorded, among which is chicken pox or sore head. Diseased chickens were submitted to the Bureau of Animal Industry of the U. S. Department of Agriculture and the disease was definitely identified by Dr. D. E. Salmon as chicken pox. The disease is called indifferently chicken pox or sore head, but since the latter name seems to be the more prevalent in the Hawaiian Islands, it is generally used in this bulletin. As far back as 1850, and probably earlier, the poultry fanciers were endeavoring to combat this dreaded malady, and to the present day this disease alone seems to be one of the great obstacles to successful chicken growing in Hawaii. Colds, bowel troubles, and other complaints were met with, but their ravages were not so great as from sore head, and for this reason little is found relating to these subjects. At the present day sore head holds first place among the diseases of the poultry yard, not excepting those which have been introduced by importations of foreign chickens and the new diseases which may have originated in this climate and which would attack the less resistant imported stock.

Sore head is essentially a malady of the hot summer months and attacks the chickens at about the age of six weeks. At the time when the disease attacks the chick it is not as heavily clothed with feathers as previously or later. Just at this time the mother hen begins to show her chicks less attention and often fails to brood them properly. At this time, too, they are subjected to the pecks of the older fowls and begin to quarrel among themselves. All these conditions render the young birds subject to diseases which they might otherwise be proof against. Then, too, lice and mosquitoes have full sway with their victim.

Sore head is due to a parasitic fungus which attacks the chicken in the most unprotected parts of the body, especially around the head and eyes. The first symptoms of the trouble are manifested

by the appearance of a very small pimple or eruption of the skin about the ear or eye, or perhaps the bill. This grows so slowly and inconveniences the chicken so little that the breeder rarely takes note of it. Later, another eruption makes its appearance, perhaps adjacent to this or perhaps on the other side of the head. Meanwhile, the first has developed into a large, scabby wart, which spreads day by day, and yet the patient does not appear to suffer greatly. The eyes then become covered with the scab and decline sets in. The bird is not able to find its food or water; a slow siege of starvation follows, and a combination of diseases attacks it, colds and roup being among the most important. Finally death comes to the weak, starving patient. The head may be one mass of scabby, watery sores. The eyes are often forced out of their sockets, and the sight is certainly a painful and disgusting one. Whole flocks are sometimes lost by the ravages of this disease, and the fact that it is contagious renders it very difficult to handle.

PREVENTIVES AND REMEDIES.

Since the disease is caused by a fungus, anything on which the spores can live will be a source of infection. The disease germs may not necessarily be confined to the body of the chicken, but probably exist also in the rubbish and sweepings from unclean houses. It is certain that the excrement of infected birds will transmit the disease. At this time, too, the chicken is still trying to huddle under the mother, and must therefore come in immediate contact with its fellows. The filth on the mother may be a harbor for the germs, although she may be resistant enough to avoid inoculation, while the brood, with their bare, henpecked, and mosquito-bitten heads, are subjects on which the fungus may find good conditions for growth. The chick, once diseased, becomes a constant menace to the rest of the flock. It drinks the same water, eats from the same trough or pan, and is bitten by lice and mosquitoes, which may then attack a healthy bird, and in time the whole flock may become infected. The detection of the disease, perhaps, needs more attention, in that people do not usually observe the trouble until the second stage of development. This is quite natural, as in a flock of small chickens it is difficult to detect one which may have an eruption on the head no larger than a pin head, but this is the time when the bird should be detected and removed from the flock. All the specimens examined, with the exception of two, were in the second or last stages of the trouble. The disease is quite likely to escape notice in the first stages, because the general health of the chick does not seem to be impaired and no other physical indications are apparent.

The disease has a regular period of development. Precautionary measures being taken to carry the patient through this period, it

will probably recover with but few ill effects, except a generally run-down physical condition. In this connection it might be added that if the warts can be kept off the eyes the bird will be able to eat and keep up strength enough to carry it through the course of the disease. Experiments are under way with this object in view and, if successful, will be a step in advance.

The remedies which have proved more or less effectual in the treatment of sore head are antiseptics, followed by healing treatments. The choice of these different remedies depends largely on the individual who handles the patient, and the matter of cost plays no small part in the selection. It is hardly to be expected that a chicken grower who has but few fowls for domestic use will expend as much money or time as one who is making his living by his poultry yards; nor can it be expected that all growers will be able to have finely equipped houses, runs, and hospitals. It is for these reasons that several remedies are recommended.

Sanitary measures will apply to all cases. When a chick is discovered with the characteristic eruption, even though it be very minute, remove the bird at once to some place where the rest of the flock can not come in contact with its food, water, or excrement. The houses in which the diseased bird has been roosting, and even the yards and fences, should be immediately subjected to a thorough disinfection. One of the best ways of disinfecting is to clean the houses, yards, and fences with scalding water, after which a coat of whitewash should be applied. Disinfectants, such as a dilute solution (from 3 to 4 per cent) of carbolic acid mixed with whitewash, or with hot water before the whitewash is put on, will be found effectual. A liberal spray of Bordeaux mixture (lime, 6 pounds; copper sulphate, 4 pounds; and water, 24 gallons) will be found beneficial. The refuse from the acetylene generator is another cleansing agent. Turpentine, tar, or washes of tar, sheep dip, or a solution of whale-oil soap may be used.

The flock of apparently healthy birds should be looked after at once. The disease may be checked at this point if proper care is taken. Each chick should be examined daily, and if found infected must be instantly removed. The head should be rubbed with carbolated vaseline or sulphur ointment, and a general tonic given in the water or food, such as a little sulphur, sulphate of iron, or Douglas's mixture. After the flock has been attended to, which is of first consideration, the diseased bird may claim attention.

On the patient, if thoroughly infected with the malady, will be found large scabs covering the side of the head, or perhaps an eye. Wash the head in warm water or soapsuds, thereby loosening the scabs. If these are not developed enough to loosen, the water softens them and removes the pus, which is a source of contagion. A car-

bolated salve can then be applied to heal the sore. If the bird has sufficient vitality it will survive and grow to be a strong fowl. Potassium permanganate (1 dram to 5 ounces of water) is sometimes used with good results, the scabs being painted with the remedy after careful washing. A dilute solution of silver nitrate (8 grains to 1 ounce of water) can be used in the same manner. Sulphate of copper (1 dram to one-half pint of water) has a place here, and also tincture of iodin. These latter remedies may prove severe and must be handled with great care. Carbolic ointment seems to be in favor with many breeders. Dipping the diseased head in warm salt water cures more or less effectually. Other poultrymen have recourse to the ointments made of the oxids of mercury and zinc. Another remedy which suggests itself is peroxid of hydrogen (3 per cent solution in water). Some poultry raisers have had good results from the use of glycerin containing 2 per cent of carbolic acid. As stated in Salmon's Diseases of Poultry, tincture of iodin, either alone or mixed with 10 per cent of carbolic acid, is a rather severe remedy and one to be applied only after other treatments have proved ineffectual. During treatment tonics and stimulants must be used. The bird must have food forced down it, if too weak to eat, or if because of blindness it can not find the food placed before it.

Since the disease has a definite period of duration, of about six to eight days, the problem in the beginning is to check or control it. As opportunity has not been afforded whereby experiments could be systematically tried upon the disease in its first stages, no satisfactory results can be recorded, but it may be stated that two methods are feasible: (1) To burn the pinhead-like eruptions with a caustic, such as iodin, permanganate of potash, or lunar caustic, and then apply a healing salve; (2) to localize the malady by painting the parts likely to be affected with an antiseptic, such as a 2 per cent solution of carbolic acid, or a strong solution of boracic acid, or listerin, and thus prevent the spread of the disease so that it will not infect the ears and eyes. It is quite evident that growers generally do not notice the trouble in the first stages until time has elapsed for the whole flock to become infected.

Mr. J. J. Green, of Honolulu, writes as follows in regard to the treatment of sore head and other diseases:

The results of repeated efforts at raising young chickens in Nunanu Valley seemed, for a season, to bear out the theory that the head disease was caused by mosquito bites. The chicks hatched during the spring and early summer of 1898 were given no protection against mosquito bites at night, and nearly all of them perished with the head disease soon after weaning, while those hatched after July were covered with a mosquito net over each brood and escaped disease. The fact that the chicks were not affected when weaned encouraged the belief that the absence of the hen and her brooding left the young entirely at the mercy of the mosquitoes, and that the latter went straight to their work,

for within a week the heads began to show the fatal marks. Yet the same chicks, at their weaning, were of a size that made it impossible for the hen to cover them all at one time, and they could be seen late in the evening sitting about her as though in no further need of being brooded. In the following season (1899) a commodious and mosquito-proof brooding house failed utterly as a preventive and dispelled the mosquito theory.

Season of 1900.—Experience had thus far demonstrated that after the eighth week the chicks were not subject to the head disease, and it was believed that a flock kept in a spacious shed, away from spring showers and the damp ground, with sunlight and fresh air plentiful, might escape the scourge. Accordingly a flock of 26 chicks (hatched in April) six weeks of age, were weaned and placed in a shed 10 by 12 feet in floor space, with lattice front facing southwest. They were furnished grass food, meat, and grit, together with the regular grain fare. At night the flock was divided and placed in two brooders, each 2 by 3 feet floor space and 2 feet high—ventilated by a rat-proof wire front of half-inch mesh. Within two weeks there appeared an eruption on the face and back of almost every chick in the flock, which soon developed into scabs. They were promptly and perseveringly treated for "sore head" with a remedy recommended by a Southern (Georgia) physician and poultry keeper—Epsom salts in the drinking water and carbolated vaseline on the affected parts. Notwithstanding, the scabs spread rapidly over and around the eyes, often closing them. The sores also appeared on the back and wings, and on the beak close to the head. Ten of this lot weakened rapidly and died before the scabs had closed the eyes; in fact many of them had but slight eruptions when they succumbed. After two weeks of treatment the 16 remaining chicks began to rally, the scabs dried and lifted off readily, leaving the skin clear and without scars. The inner surface of the scab was covered with white, thread-like roots, which drew out of the skin when lifted off. With a tonic in their drink for the next few weeks they continued safely on to maturity. Of the number saved, three were so badly blinded with the scabs as to be helpless to move about or to feed themselves. These were taken in hand to "kill or cure;" the scabs were bathed in warm water to soften them, and tincture of iodin was applied to the surface of the scabs. After the third application (in thirty-six hours) the scabs were lifted clear of the skin, leaving it somewhat raw, and the chicks lost no time in filling their crops and ranging about the yard for young grass. They recovered slowly, but never attained full size or weight. In the convalescing flock there were occasional watery eyes, and in a few there was an accumulation of hard, yellowish matter, of bad odor, in the ears, which, on being removed, was followed by several like discharges during a period of two months.

A second flock of 22 chicks (hatched in May) was weaned three days after they were hatched and placed in the same pen and brooding boxes (which had been newly whitewashed). Within a week there were lumpy formations on the beaks of most of them, which in a few days developed into scabs, and in another week all but two had died. The two chicks were raised to maturity, and though healthy, were dwarfed by the set-back occasioned by the attack. In this lot contagion was suspected, also too early weaning, though the mother hen was separated from the chicks at night only.

It now became evident that indoor brooding had no advantages, but many serious disadvantages, by depriving the chicks of healthful out-of-door exercise and keeping them tender and sensitive to weather changes, instead of inuring them to all weathers from the start.

The third flock of 7 (hatched in June) was given full liberty from the day after hatching. Early and late, wet or dry, these chicks roamed at will, and at night were brooded by the mother hen under a stairway. But, as usual, the

eighth week brought the head disease, following their weaning. Further nursing was abandoned and the disease was allowed to have its way with them for nearly two weeks. By this time the scabs were well developed, but the sturdy youngsters had kept keen appetites, and the eyes, though affected, were not blinded, so that there seemed a prospect of bringing them through. A mixture of vinegar, salt, and soda was applied to the scabs and repeated two days later. The second application brought to the corners of the eyes large, thick scabs of hardened whitish matter, which were easily removed. A day later the scabs were lifted off, showing the skin clean and dry. Without tonic or further treatment this flock reached maturity safely, showing no check in their growth.

A fourth flock of 41 chicks (hatched in August) was given its liberty from the start, and when weaned was put into the same brooders that had been used for the earlier flocks of the season. This flock matured without the slightest touch of head disease or other ailment. An October flock also came safely through.

Season of 1901.—The first hatch of the year was taken off in February, the second in March, and no head disease was encountered. In May a flock of 19 chickens was hatched, and in July they were down with about everything possible. When weaned they were housed at night in a weaning pen of 3 by 5 feet floor space and 4 feet high, with a wire front. This front had a curtain, which for a week was drawn over it regularly to protect the chicks from any sudden change of temperature while only partly feathered. The brooder (or weaning pen) seemed close and foul-smelling on opening it every morning, although it was ventilated at the top and the floor cleaned every morning and covered with fresh earth. As the nights seemed uniformly warm (in July) the use of the curtain was discontinued, thereby giving more fresh air to the flock. Soon after there came an unusually windy night, which left its imprint on the flock in unmistakable signs. They began sneezing, and the eyelids and face were much inflamed. For this they were treated with aconite. But in a few days there came the familiar marks of the head disease, which at its very first appearance was treated for chicken pox with a remedy (for that disease in chickens) obtained from a California poultry raiser—*Rhus toxicodendron* and hepar sulphuris (liver of sulphur) in the drink, and chloro-naptholeum on the affected parts—and the whole flock confined to insure regular treatment. Five of the flock died before the scabs had developed on them, apparently from exhaustion. Some died long before the scabs began to close their eyes; others held on several days after their eyes were closed. A few had canker in their mouths, and nearly all had watery eyes. Treatment availed but little—even the vinegar, salt, and soda failed. Out of the 19, 12 died of their cold, or chicken pox, or both. Of the remaining 7, 4 seemed to have passed lightly through the chicken pox only to succumb to the cold which accompanied it, and which had by that time developed into a croupy stage, there being a thick, colorless fluid discharge from eyes and nostrils which kept them shaking their heads to rid the eyes of the accumulation, then wiping their faces on back and wings. Three of the chicks survived. One passed through the siege with but the slightest touch of the disease apparent; suffered no check in growth, and developed into a fine pullet. Another came safely through the pox, but continued snuffling for three months and was somewhat stunted. The third came slowly through both pox and cold, and was severely stunted.

A single healthy chick of another brood, two weeks younger, was placed with the affected flock, and in about a week developed the fatal symptoms. In the third week it died of the head disease and without any symptoms of a cold. In this chick the first symptom observed was a lump on the beak, at its juncture with the face, which soon turned to a scab, as in the others.

The last hatch of the season, in August, showed no sign of disease and matured rapidly.

In the adult fowl the experienced poultryman has his first warning of internal disorder by the condition and color of the comb, which in health is a bright red, but in disease this red may become pale to whitish, or deeper to blackish. In chicken pox the comb becomes the apparent seat of the disease, a typical case of which was encountered in the male bird of a trio that had been cooped in a crate 30 inches square for thirteen days en route from San Francisco to this port (Honolulu). The two females were in bad condition with cankered mouths on arrival. The male showed but a slight touch of canker and seemed well for about two weeks, when gradually his comb, wattles, and ear lobes became dotted with eruptions, which increased in size and finally covered the whole surface of each part, closing his eyes and debilitating him generally. He would not eat, so had to be fed. Treatment was by dipping his head, at night, into a pint of lukewarm water in which was a tablespoonful of a proprietary poultry remedy, drying carefully, and placing him where he would be warm and out of a draft. Four days' attention brought him out safely and he soon regained perfect health. The hens showed no sign of pox, but their mouths were wedged with canker. While this trio were cooped and continuously forced to breathe an atmosphere tainted with their own droppings, whether of several nights' accumulation or of a single night, their blood must have become severely tainted and called for a reckoning. A subsequent importation, being but a week in transit, soon developed the same symptoms, but in much less aggravated form.

It is not uncommon for half-grown chicks, at the age of 4 and 5 months, to show eruptions on comb and wattles, which develop quickly into scabs (trifling in size and number, but none the less a reality), turn black, and in a few days drop off, or, if lifted off, show the same inner surface of roots as found in the smaller chicks with "head disease" and in the adults with "chicken pox." While passing through the slight attack the half-grown fowls seem listless for a few days, but rally rapidly with a little tonic in their drink. This indisposition is said to be due to the feathering process—"the putting on of the final feathers, the freedom suit, so to speak," quoting Mr. I. K. Felch in his "Poultry Culture."

In the writer's experience there seems but little needed to establish the identity of the head disease in chicks as the same affecting adult fowls. The head is evidently the point of attack. On the fowl there is a full coat of feathers to keep the body warm through the course of the disease. But the chick is only half clad and more liable to add a cold to the fever accompanying the disorder, unless completely protected against cold night air. The head disease by itself has not proven serious, in the writer's flock, needing only simple precautions; but with a cold the result is probably no less serious than would be the case of a child having the same complication.

Precautions and safeguards are more to be relied upon than medical treatment, less fatiguing, and more satisfactory in results. The first precaution must be to house the chicks, when weaned, in a comfortably warm brooder, even in this climate. Although a flock can not all be hovered at once by the hen, when nearing the weaning age, they can, when cold, crowd themselves in and out often enough to avoid a complete chill. While without the hen, if exposed to cold air, they must endure it all night by huddling into a corner, those on the inside steaming in the warmth of their own bodies until overheated and crowded to the outside of the flock by the chilled chicks. In a warm but correctly ventilated brooder they will scatter about the floor.

Further precaution should be taken to teach them to perch as soon as weaned.

Sitting on brooder floors before they can be expected to perch, and inhaling the vapors from their own droppings during a single night, certainly subjects the blood to a condition that invites almost any ailment. The droppings voided in one night by 5-weeks-old chicks are no trifle, and with young turkeys the odor from their droppings is said to act as a deadly poison. If the hen will not take them to perch when weaning, they can be taught by placing them on the perches just at dark for two or three nights. Until they can be trusted to perch all night there may be a heavy litter of dry grass under perches, which will raise them above their droppings to some extent.

The first ten days in the life of a chick is rated as one of greater or less mortality from bowel troubles. Experience shows the period between the fifth and ninth week as one of trial while putting on the first coat of feathers. The rapid feathering, which at six weeks of age has become general all over the body, must draw heavily on their strength, so that there can be but a small reserve of energy with which to combat disease, especially with fever. In the Leghorns the rapid development of wing feathers has caused such heavy mortality that clipping them to check their growth was found to be both necessary and effectual. With the Brahmas the tendency is directly the opposite, being slow in feathering and apparently willing to wait for clothing until they have strong bodies to carry it. From the age of 8 weeks the chick is consuming larger quantities of food, which probably furnish a more equal distribution of nutrients to the body and feathers. The larger they grow the more range they cover in foraging, thus promoting appetite, digestion, and assimilation.

Chicks from vigorous parent stock, well housed on low perches that are out of drafts and away from cracks in the wall, free from lice, well fed (not overfed), with occasional diet of raw meat (as per established feed formulas), linseed meal, and an abundance of green food, may be expected to thrive. One may also be on the lookout for the first symptoms of head disease in its season (which, with the writer, has invariably been in April, May, June, July, and at no other time in the year); but warm, dry, and clean quarters at night, with generous diet and a simple tonic, may be trusted as treatment. It may take cold and become roupy; kill, burn, and start anew.

DIARRHEA AND CHOLERA.

Diarrhea is a common ailment with chickens raised in tropical countries, and Hawaii proves no exception. This disease should be distinguished from cholera, which sometimes destroys whole flocks in a short time. The cause of simple diarrhea is found generally in improper food or bad drinking water. The bird becomes languid and loses appetite, the feathers have a rough and dead appearance, and a general wasting away takes place.

REMEDIES.

The food should be changed, if that seems to be the cause of the trouble. Fermented food, such as is seen in the feed dishes of some yards where the mess of the day is thrown on the refuse of yesterday, is objectionable. Good, clean, wholesome foods are necessary. The drinking water is of prime importance. It is well known that germs of many kinds find a suitable medium for growth in water that has been standing a few days. If a good stream of running

water is not available, carefully cleansed and properly constructed vessels should replace the oyster can or muddy duck trough. The water must be changed daily or, better, twice a day. The yards and houses must be kept free from old droppings, and must be sweet and clean. Ventilation should be good, without drafts. The climate of the tropics is so uniform that these precautions may seem unnecessary, but a fall of temperature of only a few degrees, accompanied by a wind, is sufficient to affect healthy chickens if not properly housed. Scalded milk is found very effectual in light cases of diarrhea. A handful of oatmeal placed in the water is found advantageous. Olive oil is a good laxative, and is useful in removing any irritating particles which may be lodged in the intestinal canal.

A more powerful remedy must be given in severe cases of cholera. Doses of bicarbonate of soda and powdered opium, with subnitrate of bismuth; mixtures of laudanum, tincture of capsicum, tincture of camphor, chloroform, and alcohol have proved efficient.

COLDS, DISTEMPER, AND ROUP.

These diseases are of so complicated a nature and so closely related that it will be impossible in this bulletin to go into details respecting them. Full and careful descriptions have been given by Salmon in his book on "The Diseases of Poultry." It suffices to say that this whole series of diseases is indirectly due to sudden changes in the weather, filthy houses full of cracks which cause drafts, and a general lack of attention to sanitary conditions.

COLDS.

Colds are very prevalent among chickens in Hawaii. They often develop in a short time, even with the best of care and under apparently perfect conditions. While light colds may not be contagious, it would be wise to remove the sick bird and give it clean and warm food and any good warming stimulant, such as a little ginger.

DISTEMPER.

Authorities differ as to whether this disease is an independent malady or whether it is immediately associated with roup. Whichever it may be, the treatment here given has proved more or less effectual. The bird affected with this trouble manifests a listless, quiet manner. The face is puffed under the eye. On the second day a white froth is discernible in the corner of the eye. There is also loss of appetite. If taken in time it is only necessary to wash the head and beak with a dilute solution of carbolic acid. Keep the bird in a quiet place, giving it nothing but water in which a little bromid of potassium has been dissolved.

ROUP.

If detected in the flock, roup should be immediately stamped out by killing and burning the infected fowls. The disease is caused by bacteria and is infectious. The symptoms of the disease are very pronounced, and are as follows: A running at the nose and eyes, an offensive odor, caused by the discharge which is deposited on the feathers from the bird's beak; a gathering about the eyes, which in time may force the ball out of the socket. Breathing soon becomes difficult and the patient finally succumbs to a painful death.

However, in case the fowl is considered too valuable to destroy, antiseptic and healing remedies may be applied to the throat and diseased portions of the head. Some of the remedies recommended are boric acid, 15 grains to an ounce of water; carbolic acid in 2 per cent solution; peroxid of hydrogen, diluted with an equal quantity of water; permanganate of potash, 1 grain to an ounce of water. Kerosene also finds favor. Steaming the head over hot water containing a little carbolic acid has been recommended. A spoonful of castor oil internally should follow these lotions.

INTESTINAL WORMS.

The variety of these worms is so great that mention will be made of them only as a class.

The sanitary conditions which prevail about the Chinese huts are so bad that worms and germs of all kinds find breeding places there, and it is not surprising that many of the fowls are subject to the diseases caused by these parasites. The symptoms of infection are not characteristic. The birds may act and appear as they do when affected by many other troubles. They become emaciated, lifeless, do not seek for food, and at times suffer from diarrhea. The best proof of the existence of the malady is to examine the droppings for either the worms or their eggs; better still, to examine a bird which is suspected of having died from the effects of worms. If infected, there will be found in the intestines both the worms and their eggs.

The purpose of treatment should be to kill the living worms or eggs and then to administer a purgative. A vermifuge should be given early in the morning before the bird has been fed; follow this in six hours with a dose of castor oil. Powdered areca or betel nut is advocated for tapeworms; oil of turpentine for worms which inhabit the passages of the intestines. Garlic is recommended for the gapeworm trouble.

Preventive measures, such as changing the yard and run of the flock every few years, are recommended. The droppings of the infected birds (which must be isolated) should be burned. The houses should have a careful disinfection with dilute carbolic acid

and water, or some other good disinfectant. Kerosene, tar, sheep dip, and whitewash are excellent for this purpose.

LICE AND VERMIN.

All yards are more or less troubled by these pests, and while they may not be the immediate cause of disease, they act as carriers of germs, as do mosquitoes.

Cleanliness is the most effectual remedy. Spraying the house with kerosene, a free use of insect powder on the birds, plenty of sunlight in the house, and an occasional sprinkling of sulphur on the floor of the house, are recommended. The nests in which the hens lay their eggs must be cleaned frequently, and if straw is used in the nest, it should be burned and fresh straw put in its place at least every month. Should a bird be found to be suffering from lice to any great extent, it should be thoroughly rubbed with lard which contains a trace of carbolic acid. Tar soap and sheep dip will kill the lice on the bird; and will also act as a preventive.

BREEDS FOR THE TROPICS.

The common fowl of to-day is the result of years of cross-breeding with good and poor stock. Since so many breeds have been introduced into Hawaii, it is difficult to state which is the best for this climate. Observations have shown, however, that the lighter breeds, such as the Leghorn type, seem to be freer from disease than the heavier varieties. The Mediterranean types are better adapted to tropical conditions than the Cochins. The fact that the "native bird" is of the first-named type is evidence that the lighter birds will stand the heat and be less subject to changes of climate. Of the heavier birds the Plymouth Rock would be best suited to this climate. In the island of Guam chickens seem to thrive, and although all breeds are perhaps represented, particularly the Spanish, yet it is stated that there are very plain streaks of Plymouth Rock in the mixed breeds.

In the introduction of new stock it must be borne in mind whence they came and under what conditions they were raised. Fowls as well as animals may be bred for some particular feature, and will thrive in their own peculiar environment; but take them to another climate, or place them under entirely new food conditions, and it may be that their high breeding renders them unable to resist the sudden change. Even though they survive and rear flocks, the newly hatched chicks may change in characteristics, which may prove detrimental to the succeeding generations.

A possible method of securing good chickens would be to take the native bird as a base and establish a breed from it, selecting the characteristics most needed for this climate.

FOOD.

The problem to be met in feeding poultry in warm climates is to avoid heating materials for foods. Oat meal and wheat are fed with good results, although the high prices paid for these materials must be considered. Green food of some sort is necessary to keep the bowels in working order, and an occasional feed of meat is not injurious. Ground bone and some form of lime, such as broken shells or coral, should be kept within their reach. Stock men are interesting themselves in drying and grinding the algaroba bean or pod. This makes a good, sweet meal, and is quite nourishing. Examination shows than the pod is made up of three parts—the outer skin and pulp, the dry seed covering, and the seed. If the pods are fed whole, the birds will merely pick a little of the skin and pulp, leaving the seed, which amounts to 280 pounds to the ton of very nourishing material, while, if ground, the whole bean is eaten.

Now that melons and squashes are grown in Hawaii with so much difficulty, because of the ravages of the melon fly, the papaya can take their place. The papaya is in itself a promoter of digestion. In early days the natives fed poi to the chickens, but that article of food has become so scarce that the chickens will have to accept a substitute. Sweet potato tops make good greens for fowls, and, with the abundance of green grass, even yard-grown chickens can have a green food diet.

SHELTER.

The requisites for shelter of chickens are good ventilation, dry roosting places, and a house which can be thrown open to the sun in the day. Protection from the wind is necessary. An expensive house is not required, but such places as are adjacent to many of the Chinese huts are beyond all reason. In some of these places the chickens have their nests under the owner's bunk, and in corners so dark and filthy that disease germs of all kinds must certainly lurk there. The proper location of poultry yards is a matter for consideration. In early times the farmers in Hawaii learned that birds raised in one section of the islands were subject to sickness if transported to another. Even the elevation of a few hundred feet had a noticeable effect. This is quite true, and therefore farmers introducing fowls from other sections of the islands must use as much precaution as though they were shipped from foreign lands.

The season for raising broods has been the subject of long experiment. While hens may be willing to set at any time of the year, early spring is the best time for hatching. In this case the birds will be, by summer, strong enough to resist the diseases brought on by the summer heat.